



SUPERCPU

VERSION 2

USER'S GUIDE

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INTRODUCTION

WHAT IS THE SUPERCPU?

The SuperCPU is an accelerator cartridge that speeds up the operation of your computer. It accomplishes this by using a combination of high-speed RAM, custom logic and a fast microprocessor which combine to emulate the functions of similar components located inside your computer.

Using the SuperCPU, programs will run up to 22 times faster on your computer. This makes the SuperCPU an effective hardware tool for increasing the performance of programs that otherwise get bogged down due to heavy computational requirements or inefficient programming. BASIC programs, for example, will often appear to run as fast as machine language programs do on a stock machine.

As you get to know your new SuperCPU, you'll also discover that there are some operations that a fast microprocessor alone cannot speed up, such as disk access. Although your computer can operate much faster, your disk drive isn't capable of matching this speed without some help. With the JiffyDOS Kernal built into the SuperCPU, adding a JiffyDOS drive ROM to your disk drive(s) can also boost disk access by up to 1500%.

In addition to disk access, the 80-column VDC chip used on Commodore 128 computers causes a substantial bottleneck. Writing just a single character to the 80-column screen requires several slow I/O operations, which severely limits the SuperCPU 128's ability to speed up programs that use this mode. In the Programming section of this manual, you'll find some useful information on getting more speed out of programs that operate in this mode, as well as well as for programs that operate in other modes.

While there are other operations which require the SuperCPU to slow down, most of these aren't noticeable to the user. Overall, your system will operate many times faster than a stock machine, and we're certain you'll appreciate the performance provided by the SuperCPU.

SUPERRAM CARD

The CMD SuperRAM card is an add-in card for the CMD SuperCPU 64 and SuperCPU 128 accelerator cartridges. This card will allow the addition of 1, 4, 8 or 16 Megabytes of RAM which the 65816 processor of the SuperCPU can directly address. A single SIMM (Single Inline Memory Module) socket on the SuperRAM circuit board provides this expandability using standard 72-pin fast-page mode SIMM modules.

The additional memory provided on the SuperRAM card requires custom programming in 65816 code. At this time, there is no easy way for BASIC programmers and general users to make old programs work with this extra memory. CMD has provided patches that allow GEOS to use up to 2 MB of RAM from the card, and has other projects planned that will use expanded RAM. However, other programs will need to be modified or written by programmers to provide additional usefulness. A number of developers have indicated that they do have programs in development to help fill this need.

POWER REQUIREMENTS

The SuperCPU requires a substantial amount of current from your computer's power supply. Commodore 128 (and 128-D) computers provide ample power for this device. However, if you use your SuperCPU on a Commodore 64 or Commodore 64c, we highly recommend a heavy-duty power supply. CMD offers such a supply for customers in the United States and Canada, CMD Order Code: POWER64HD. Customers outside North America should check with sources in their country for an adequate power supply. *IMPORTANT NOTE: The SuperCPU also requires that your power supply be close to the nominal operating voltage. Power supplies that provide less than 4.85 volts may cause the SuperCPU to operate incorrectly.*

WARNING: The power requirements of the SuperCPU will very likely shorten the life expectancy of stock C-64 power supplies.

CONTACTING CMD

If you experience difficulties with your SuperCPU, first check the sections of this manual that cover compatibility and troubleshooting. If you're unable to resolve the problem, you may contact Technical Support via one of the methods listed below:

CMD Technical Support
P.O. Box 646
East Longmeadow, MA 01028-0646

Phone: 413-525-0023 (1 PM—5:30 PM EST, Mon.—Fri.)
Fax: 413-525-0147 (24 hrs)
E-mail: support@cmdweb.com

CMD also offers a wide range of additional programs and hardware for Commodore users, as well as additional technical information and programming data for the SuperCPU. To request a catalog or to order additional products, call our order desk at 1-800-638-3263 (9:30 AM—5:30 PM EST, Mon.—Fri.). In addition, the CMD website, CMDWEB, provides an online version of our catalog, support files, and news. Please visit us at:

<http://www.cmdweb.com/>

SUPERCPU INSTALLATION

INSTALLING THE SUPERCPU

If you are installing a SuperCPU (64 or 128) on a Commodore 64, or if you are installing a SuperCPU 64 on a Commodore 128 computer, skip ahead to the section entitled *Installing the Main Unit*. If you are installing a SuperCPU 128 on a Commodore 128 computer, then you'll need to perform the *MMU SuperAdapter Installation* before installing the main unit.

MMU SuperAdapter Installation

This procedure covers removal of your computer's MMU chip, installing that chip into the MMU SuperAdapter, installation of the MMU SuperAdapter into the MMU socket, and attachment of microclips to pins on your computer's microprocessor. This procedure requires good eyesight, manual dexterity and should be performed in a well-lit area.

WARNING: Improper installation may cause permanent damage to your equipment. CMD is not liable for damages caused by improper installation. If you feel incapable of performing this installation, CMD can do it for you for a nominal fee.

Tools Required

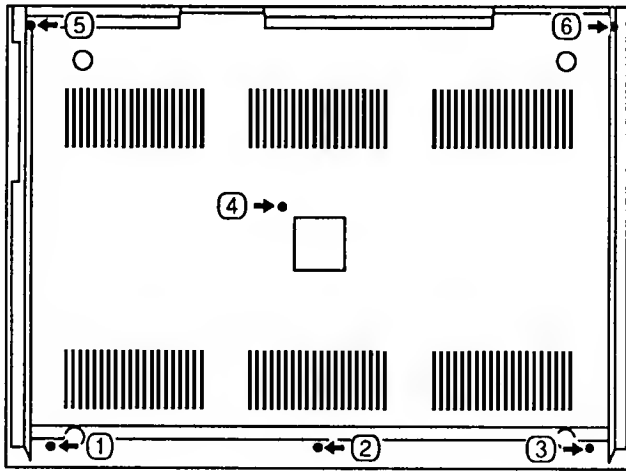
To perform this installation, you'll need either a Phillips screwdriver (#2) or a Torx screwdriver (T10); both are available from Sears. You'll also need a chip extractor or a small flat-blade screwdriver to extract the MMU chip from your computer. Since the parts you'll be handling are static sensitive, we advise wearing an anti-static wrist strap.

Procedure

Please follow the steps provided carefully and in order.

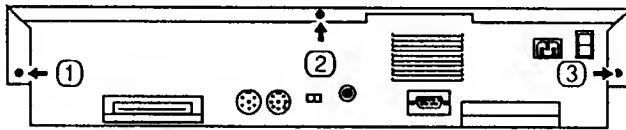
- ▶ Make sure that your computer and all attached peripherals are turned off.
- ▶ Remove all cables, cartridges and any other external attachments from your computer, including the keyboard cable if you have a C-128D.
- ▶ Move your computer to a well lighted area for disassembly.
- ▶ Using the Screw Removal diagrams, locate and remove the screws designated for your particular model. (*Note: If you have a plastic 128-D, commonly found outside the United States, you'll need to locate the screws on your own.*)
- ▶ The next step is to separate the two halves of the case. This is done differently, depending on whether you have a C-128 or a 128-D computer. Each of these methods is outlined in the following steps:

C-128 Screw Removal

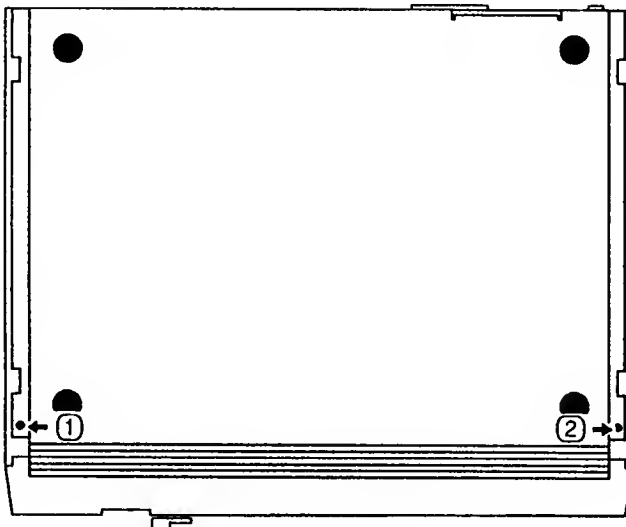


Case Bottom Screws (6)

128-D Screw Removal



Case Back Screws (3)



Case Bottom Screws (2)

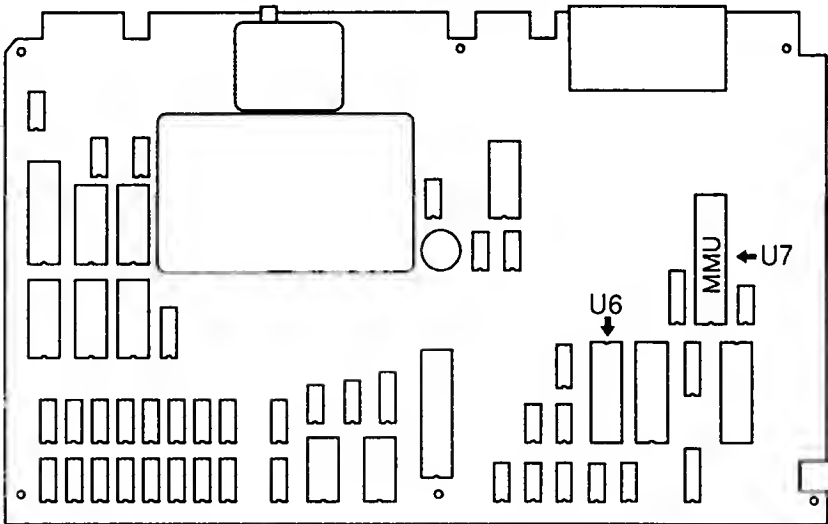
C-128: ► Place the computer in front of you with the keyboard toward you.

- Separate the upper and lower halves of the case at the seam along the left side of the computer. Lift the left side of the keyboard until it is tilted upward far enough for you to gain access to the inside.
- Unplug the indicator light cable from the left side of the circuit board.
- Unplug the keyboard cable from the circuit board and unfasten the keyboard ground strap. *Note: The keyboard connector may be snug and difficult to remove. Work it off carefully by alternately lifting each end of the connector.*
- Place the top section of the case aside; it won't be needed until reassembling the unit.
- Remove the screws securing the metal shield that covers the circuit board. Untwist the metal tabs around the perimeter of the shield. Remove the shield and set it aside. *Note: The shield may be soldered at a point along the right side. If so, you can: (1) Unsolder the shield, or (2) Break the solder joint by twisting the shield (you will not be able to reinstall the shield after installing the MMU SuperAdapter, so breaking it isn't a concern).*

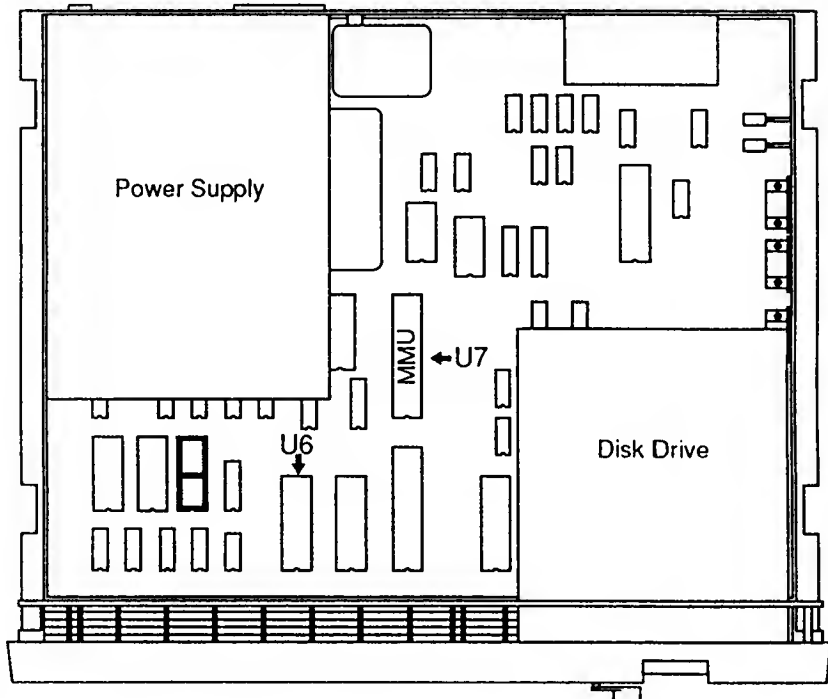
128-D: ► Place the computer in an upright position, with the front of the unit facing you.

- Slide the top cover back about 1 inch toward the rear of the unit. *Note: This may be difficult as the cover is usually tight fitting.*
- Remove the cover by lifting it straight up. Set the cover aside.
- Now that you have an open computer in front of you, locate the MMU chip, designated as U7 on both the C-128 and the 128-D circuit boards. This chip is near the center of the circuit board on the 128-D, and far right of center on the C-128. See the Board Layout diagrams to help locate this chip. *(Note: The plastic 128-D circuit board is more like the C-128 circuit board, but presently we do not have further information on the location of the MMU chip on that model.)*
- Remove the MMU chip from its socket using an IC extractor or a small flat blade screwdriver. Lift the chip out slowly by alternately prying each end of chip upward a little at a time. Be sure you're prying the chip itself—not the socket which is underneath it, and avoid damaging or bending the pins on the chip. Also, if you're using a screwdriver, be careful not to damage the circuit board while prying the chip out.

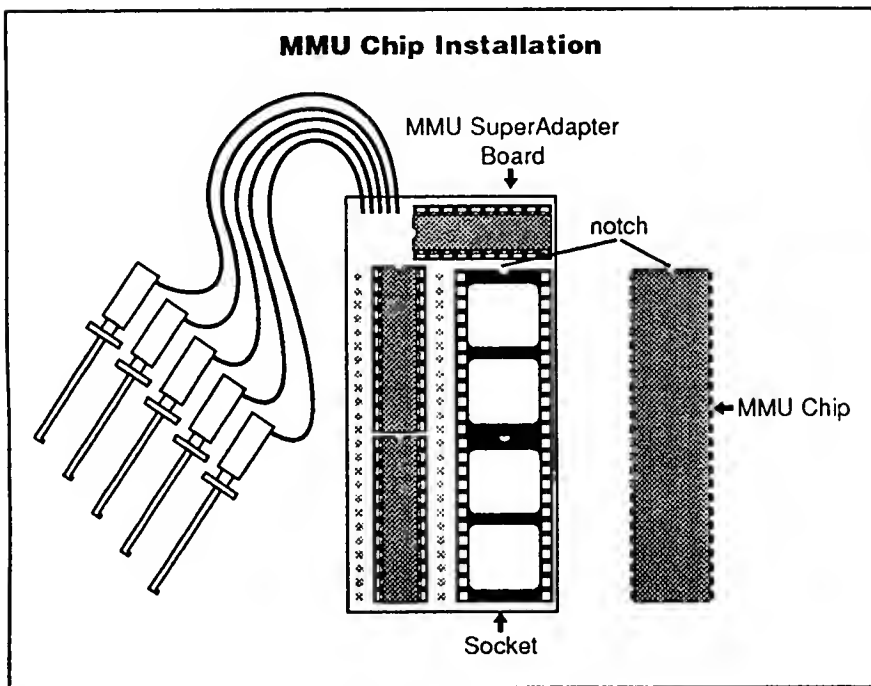
C-128 Board Layout



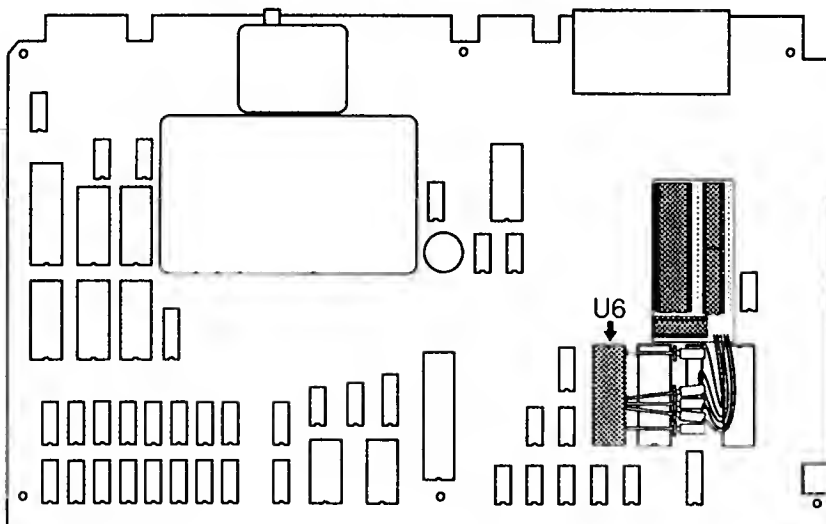
128-D Board Layout



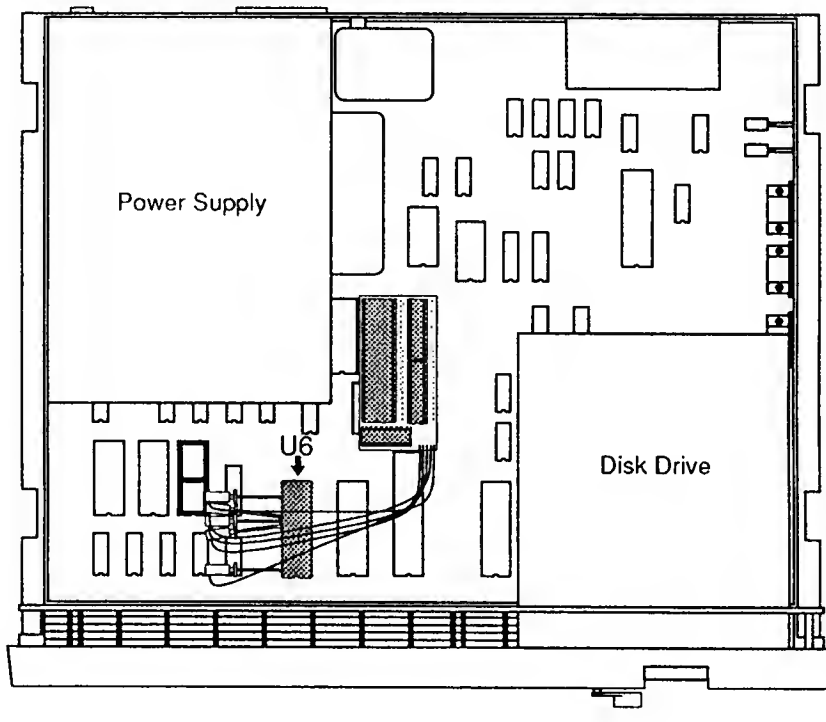
- Install the MMU chip into the empty socket on the MMU SuperAdapter board. Make sure that the notch at one end of the MMU chip is oriented correctly and that all the pins are properly aligned with the socket before firmly pressing the chip into the socket. See the *MMU Chip Installation* diagram for assistance.
- The next step is to install the MMU SuperAdapter into your computer. Note that the board has a DIP header connector on the back side. The pins of this header will be mated to the MMU socket on your computer motherboard (the one you removed the MMU chip from). Before installing the MMU SuperAdapter in your computer, make sure that none of the pins on the header are bent. In both the C-128 and the 128-D, the MMU SuperAdapter is installed with the MMU chip's notch facing the front of the computer (see the *MMU SuperAdapter Installation* diagrams). Set the header pins into the socket carefully, and peek under the top and right edges of the MMU SuperAdapter to make sure the pins are correctly aligned before firmly pressing the assembly into the MMU socket.
- Now you must attach the MMU SuperAdapter microclips to specific pins on the 8502 microprocessor (U6). This can be difficult if not done in a specific way, so please see the *Installing Microclips* diagram for details. Each microclip has a number that corresponds to the pin number on U6 to which that clip must be attached (pins 24, 28, 29, 30 and 39). Looking at the SuperAdapter Installation diagrams, note that U6 (the 8502) is mounted with the notch toward the rear of the C-128, and toward the front of the 128-D. You may use the *8502 (U6) Pin Numbers* diagram as a guide for



C-128 MMU SuperAdapter Installation

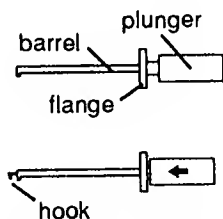


128-D MMU SuperAdapter Installation



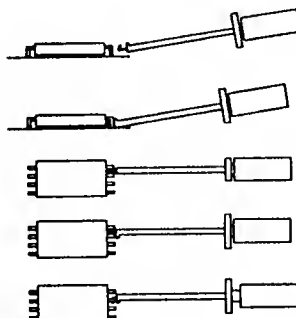
attaching the microclips, but before you begin use the diagrams to correctly locate U6 and pins 24, 28, 29, 30 and 39. **To make things easier, use the method described in *Installing Microclips exactly, beginning with pin 39 and working your way down to pin 24.*** Note: Hooking the clips to the wrong pins usually won't cause any damage to your computer or SuperCPU, but can cause the SuperCPU to operate incorrectly either all or part of the time.

Installing Microclips



The diagrams to the left show the various parts of a microclip. To install a microclip you grasp the barrel between your forefinger and middle finger just below the flange. Place the face of your thumb on the end of the plunger. Depressing the plunger by applying pressure with your thumb causes the hook to emerge from the other end.

To attach a microclip to an IC pin, note the diagrams to the right. Hold the microclip close to the target pin of the IC, and depress the plunger with the hook pointing up. Next, insert the hook between the target pin and the next pin to the right of it. Keeping the plunger depressed, rotate the microclip 90 degrees counter-clockwise, so that the hook is inserted behind the target pin. Release the plunger, and check to make sure you have a firm connection.



8502 (U6) Pin Numbers

notch C-128 Orientation

1	40
2	39
3	38
4	37
5	36
6	35
7	34
8	33
9	32
10	31
11	30
12	29
13	28
14	27
15	26
16	25
17	24
18	23
19	22
20	21

Arrows indicate pins which require a microclip connection

128-D Orientation

21	20
22	19
23	18
24	17
25	16
26	15
27	14
28	13
29	12
30	11
31	10
32	9
33	8
34	7
35	6
36	5
37	4
38	3
39	2
40	1

notch

- With the microclips installed, double-check your work. If you're sure that you've done everything correctly, proceed by reversing the steps you used to disassemble your computer in order to reassemble it. **C-128 users, take note: *You cannot reinstall the metal shield with the MMU SuperAdapter installed, but this will not cause any problems with your computer.*** Briefly, you'll need to (1) Place the top section of the case back onto the bottom, (2) Reconnect the keyboard and LED connectors. (C-128 only), and (3) Close and reassemble the case using the screws that were removed during disassembly (both models). *Note: you may want to test the SuperCPU before replacing all the screws.*

Installing the Main Unit

Whether you have a SuperCPU 64 or a SuperCPU 128, you may install it on any Commodore 64 or 128 computer. However, only a SuperCPU 128 will provide a working Commodore 128 mode on Commodore 128 computers that have the MMU SuperAdapter installed. Installing the SuperCPU cartridge itself is fairly simple—just plug it into the cartridge/expansion port (this port is located at the far left when viewing your computer from the rear). Keep the following precautions in mind:

- Make sure the unit is level and that the SuperCPU circuit board is properly aligned with your cartridge port connector before firmly pressing it into the connector.
- Never install or remove the SuperCPU while your computer is turned on—doing so could damage your computer, the SuperCPU, or both.
- Do not install the SuperCPU into a cartridge port expander—the SuperCPU should be plugged directly into the computer.
- If you have a RAMLink that normally requires a timing jumper clip, this is no longer necessary while the SuperCPU is enabled—but it is required if the SuperCPU is disabled. If you require a longer RAMLink timing jumper clip assembly, contact CMD.
- If your computer has any custom internal modifications, be aware of potential conflicts (see *Hardware Compatibility* in the *Using The SuperCPU* section for details).

Powering Up Your SuperCPU

After you have completed the installation, replace just your power supply and monitor connections—do not connect any other devices to your computer or SuperCPU at this time. C-128 users should check the position of the 40/80, CAPS LOCK and SHIFT LOCK keys—these may have changed during installation.

First, turn on your monitor and let it warm up for a few seconds. Next, turn your computer on. After 2 or 3 seconds, a screen with the SuperCPU logo should appear. If your monitor remains blank for more than 5 seconds, turn off your computer and double-check your installation. For additional assistance, see the *Troubleshooting Tips* section.

After the SuperCPU logo screen disappears, you should see the BASIC startup screen, and the familiar READY prompt and flashing cursor.

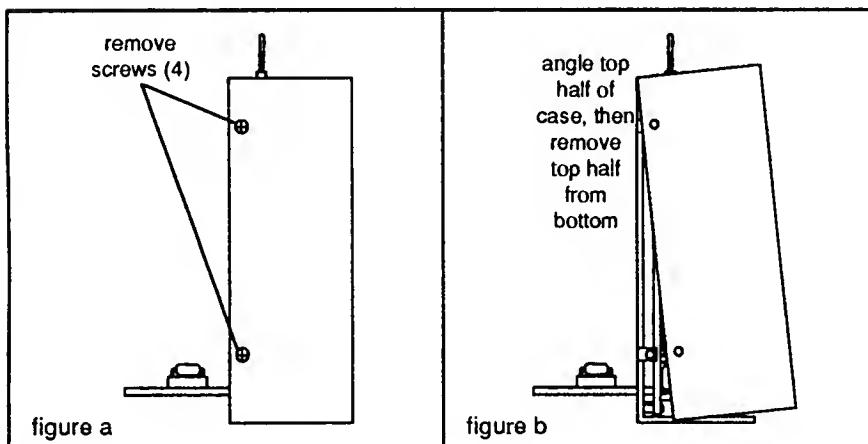
C-128/128-D users: If you have the MMU SuperAdapter installed your computer should have access to both 64 and 128 modes. If your computer always goes directly into 64 mode with the SuperCPU enabled, the MMU SuperAdapter has not been installed correctly. Turn off your computer, and double-check your installation.

SUPERRAM INSTALLATION, UTILITIES & SIMM INFORMATION

Installation

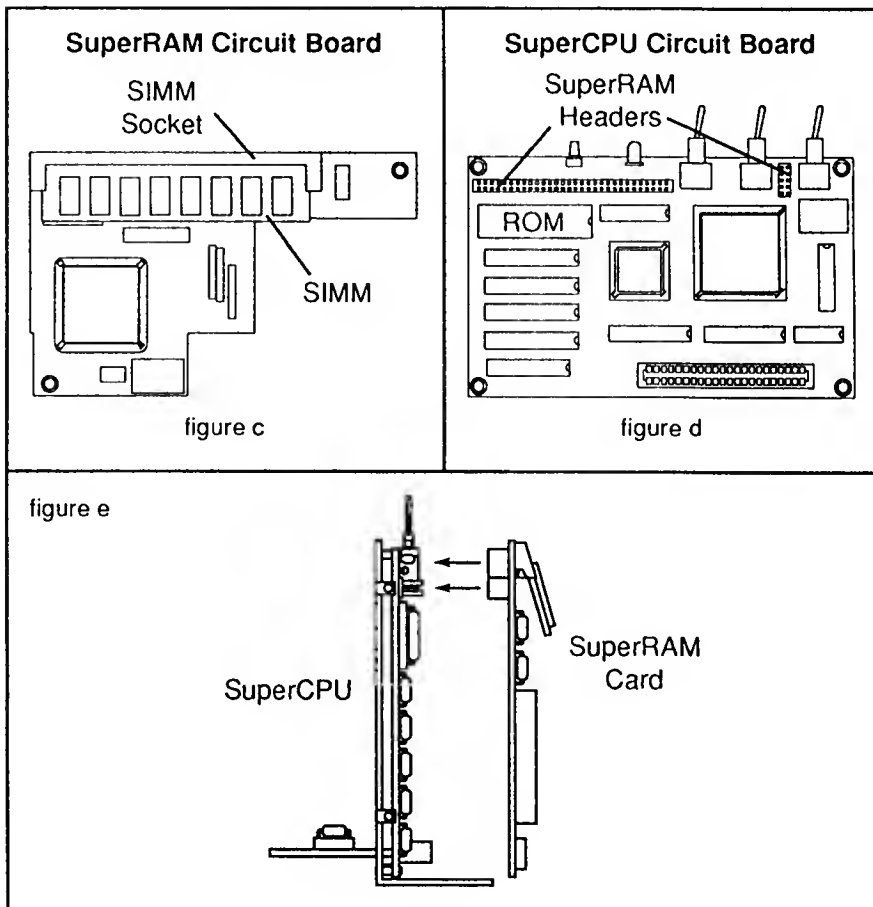
To install a SuperRAM card into your SuperCPU, use the steps that follow. *Please note that static electricity can damage the circuit boards you will be handling, so it is wise to use an anti-static wrist strap and take any other possible precautions to avoid static discharge. If you feel you aren't capable of performing the installation, contact CMD for rates on professional installation.*

- ▶ Before installing the SuperRAM card, turn off your computer and all peripherals, and remove the SuperCPU from your computer's cartridge port.
- ▶ Remove the four (4) screws that hold the case together (two per side—see figure a).
- ▶ Separate the two halves of the case so that you have full access to the circuit board in the lower half. The upper half is easier to remove from the bottom half if you angle it slightly, then work it up off the switches at the top (see figure b).
- ▶ If your SuperRAM card came with an upgrade ROM, then remove the old ROM from the SuperCPU main board (see figure c), and replace it with the new one. You may use either a chip remover or a small flat blade screwdriver to remove the old chip from its socket. Make sure that you note the proper orientation of the chip and that you insert the new one correctly. Also make sure you have all the pins aligned with the socket before you firmly press the new chip into place.



- ▶ If you intend to install your own SIMM in the SuperRAM card, you should do so before moving on to the next step. The location of the SIMM socket on the SuperRAM card is shown in figure c. *Note: 72-pin SIMMs are notched and can only be installed one way.*
- ▶ To install the SuperRAM card onto the SuperCPU main board, you must align the two connectors located on the back of the SuperRAM card with the two mating headers on the front of the SuperCPU main board, then firmly press the two boards together. Refer to figures d and e.
- ▶ Re-assemble your SuperCPU.

Your SuperCPU with SuperRAM card is now ready to use, and should display the amount of extra memory found when you start your computer. However, before proceeding further, we recommend that you run the SUPERRAMTEST program included on the SuperCPU Utilities disk (instructions are provided later in this section). This program will verify that



your SuperRAM card is fully functional. If you have any problems with the operation of your unit, refer to the *Troubleshooting* section of this manual for assistance.

SIMM Information

The SuperRAM card contains a single 72-pin SIMM (Single Inline Memory Module) socket where the RAM SIMM is installed. The SIMM socket can be fitted with 72-pin memory modules containing from one to 16 Megabytes of standard Fast Page DRAM. It's very important to make sure that the SIMM used is standard Fast Page; EDO, SDRAM and other types of 72-pin SIMM are not compatible and will not operate correctly. The memory must be rated at 70ns or faster (the lower the number, the faster the speed rating). Please note that faster RAM doesn't translate into better performance. The SuperCPU's DRAM controller has fixed speeds for performing memory access.

For information on compatible SIMMs, see the *SIMM Support Information*. This chart defines all SIMMs approved for use with the SuperRAM card.

SIMM Support Information

This chart indicates the size and organization of 72-pin SIMMs supported by the SuperRAM card for the SuperCPU. All SIMMs must be Fast Page Mode type, 70ns or faster.

Capacity	Organization	Row Size	Row/Col
1 MB	256K x 32/36	2 KB	9/9
4 MB	1M x 32/36	4 KB	10/10
8 MB	2M x 32/36	4 KB	10/10
8 MB	2M x 32/36	4 KB	11/10
16 MB	4M x 32/36	4 KB	11/10
16 MB	4M x 32/36	4 KB	12/10
16 MB	4M x 32/36	8 KB	11/11

SUPERRAMTEST

This utility has been created to assist you in making sure that your SuperRAM card is properly installed and fully operational. To load the program, insert the SuperCPU Utilities disk in your floppy drive (device 8) and type:

```
LOAD "SUPERRAMTEST", 8
```

Be sure to press the **(RETURN)** key to complete the command. After the program has loaded, type RUN and press the **(RETURN)** key.

When the program begins, it will prompt you to make sure that you wish to test the SuperRAM card. Answer yes by pressing the **(Y)** key, and the test will begin. As the test proceeds, it will first test the memory in your computer that will be used to verify operation of the memory installed on the SuperRAM card. The program will then begin testing the SIMM memory installed in the card. As each test is completed, the program will indicate that your unit has passed by placing an OK message next to the test description. The program will use various bit patterns to test the complete memory. This test can take several minutes, but you should notice that it will change the bit pattern info as the test progresses.

When the test successfully completes, it will display a message to that effect. However, if at any point a failure occurs the test will end, indicating ERROR instead of OK for the status of the particular test that failed. If you get a such a failure, try the troubleshooting steps below before contacting CMD Technical Support.

- If you have any additional cartridge-port hardware attached to your system, remove it and try the test again.
- Re-seat the SuperCPU in your computer's cartridge port and run the test over again.
- If the test fails again, check to make sure the SuperRAM card and SIMM are properly installed, and run the test again.
- If the test still fails, check the alignment of the contacts on your cartridge port, re-align them if necessary, and make sure they are clean. Test again if you found any deficiencies that you have corrected.
- Try testing the SuperCPU on another computer if you have access to one.
- Try testing the SuperRAM card in another SuperCPU if you have access to one

Be sure to take notes on what test the device fails, and what the results were to each of the troubleshooting steps you took. Should you need to contact CMD Technical Support, this information will help speed determination and resolution of the problem. Above all, do not send the unit back to CMD until you have contacted CMD Technical Support for a Returned Material Authorization (RMA) number.

SUPERRAMDETECT

This program serves mainly as an example for programmers to show them how to detect a SuperRAM card installed in a SuperCPU, as well as determine the amount of RAM that is installed in the card.

SUPERRAMFAKE

This is a programmer's utility that can be used to modify the RAM registers in the SuperCPU, making it possible to test RAM detection routines for different amounts of RAM. With some slight alterations, it could also be used to place any version string into the area of memory where that is stored (presently the program writes "1.40" to that area). Pressing the reset button on the SuperCPU will return these areas to normal.

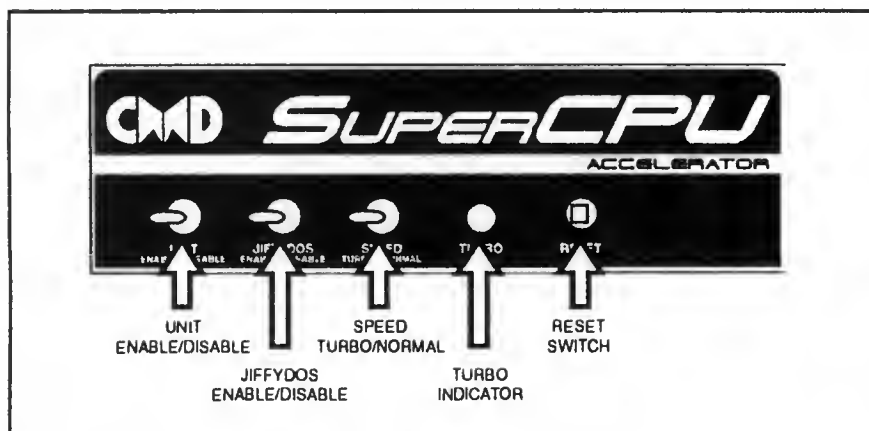
CONTROLS, INDICATORS & PORTS

UNIT (ENABLE/DISABLE)

This switch is used to completely enable or disable the SuperCPU. Normally, you would leave this switch in the ENABLE position. However, if you have a program that is incompatible with the SuperCPU, you'll need to move the switch to the DISABLE position. **Note: Commodore 128 owners must use the DISABLE position with the SuperCPU 64 to place their computer into 128 mode.** Changes made with the UNIT ENABLE/DISABLE switch position only take complete effect after a reset. We recommend that you reset your computer immediately after changing the switch position, as failing to do so can cause improper hardware operation. Note: Disabling the SuperCPU also disables the JiffyDOS routines supplied by the SuperCPU.

JIFFYDOS (ENABLE/DISABLE)

This switch controls the JiffyDOS routines supplied in the SuperCPU. With the switch in the ENABLE position, JiffyDOS will be active; in the DISABLE position, JiffyDOS will not be active. Bear in mind that this switch only controls the JiffyDOS enhanced serial bus routines. If this switch was enabled when you started your computer and you wish to disable the JiffyDOS wedge commands, function and control key assignments as well as the JiffyDOS disk drive speed enhancement routines, you should enter the @Q command before moving this switch to the DISABLE position. If you reset your computer, or turn it on with this switch disabled, then all JiffyDOS functionality will be disabled.



SPEED (TURBO/NORMAL)

This switch controls the speed of the SuperCPU. While in Turbo mode, the SuperCPU usually operates at 20 MHz, and in Normal mode it operates at 1 MHz (or 2 MHz on Commodore 128 computers when in *Fast* mode). Please note that the Turbo mode can be disabled via software as well, so programs that have been written (or modified) for the SuperCPU may cause your computer to operate at Normal speed at certain times, even though Turbo mode is selected. Please note that all standard disk access will cause the SuperCPU to slow down temporarily to 1 MHz. This switch can be changed 'on-the-fly', even while running complex programs.

TURBO INDICATOR

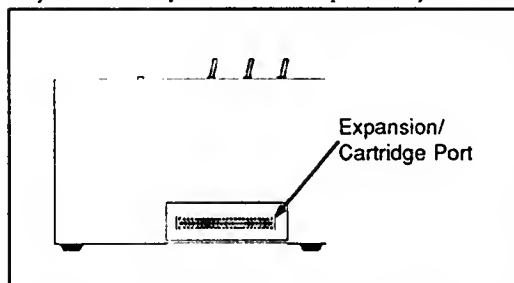
The Turbo indicator provides a visual indication of what speed your SuperCPU is operating at. When running at Normal speed, the indicator is off, while at 20 MHz the indicator is on. During disk access, it is normal for this indicator to blink while the operating system changes speed to communicate with peripheral devices.

RESET

The reset switch can be used to reset your computer. To do so, press and hold the reset switch for approximately one and a half seconds. Quickly tapping the reset switch causes an NMI (Non-Maskable Interrupt) instead of a full reset.

EXTERNAL CARTRIDGE PORT

The SuperCPU has an external cartridge port located in the rear. This port has the same connector and pin assignment as the cartridge/expansion port on your computer. As you may have already assumed, this port lets you attach cartridges normally used with your



computer's cartridge port. Be aware, however, that most cartridges which contain memory will not operate at 20 MHz. The SuperCPU determines when memory or I/O access via a cartridge is being performed, and adjusts its speed accordingly. However, some cartridges use

hardware configurations which are incompatible with the SuperCPU. Further information on this subject can be found in the *Hardware Compatibility* section of this manual.

INTERNAL EXPANSION PORT

Your SuperCPU also contains an internal expansion port, which is split into two connectors labeled P3 and P4. These connectors combine to provide all the signals necessary to connect the optional SuperRAM card. Information about this card can be found elsewhere in this manual.

USING THE SUPERCPU

STARTING YOUR COMPUTER

When you turn on your computer with the SuperCPU enabled, the Turbo indicator should light (provided the Turbo switch is enabled) and a screen containing the SuperCPU logo should appear. After this screen clears, your monitor may briefly display random characters as the SuperCPU takes over control—this is normal, so don't be alarmed. After the SuperCPU is fully initialized, you should see the familiar colors of the startup screen with the cursor blinking below the word READY.

Take note of the startup message at the top of the screen; provided you have the SuperCPU enabled, it should report the SuperCPU DOS version number. The startup message will also report the expanded RAM capacity on a SuperRAM card if you have this option installed.

If your computer does not initialize fully, remove any excess cartridges and try again. If you don't have any extra cartridges plugged into your SuperCPU, or if removing them doesn't resolve the problem, turn your computer off and refer to the *Troubleshooting* section of this manual.

Provided your computer has initialized properly, you may begin using it as usual once the normal start-up screen appears. As indicated in the section describing the controls, you may change the settings of the JiffyDOS and/or Speed switches at any time. Generally, you'll want to keep both of these switches in their enabled positions unless you run into specific compatibility problems (see *Testing Software*, later in this section).

OPERATING MODE OPTIONS

When your SuperCPU initializes, it defaults to operating in the *No Optimization All Memory* mode with mirroring of zero page and stack (\$0000—\$01FF) turned off. This speeds up common processor operations, and speeds up program execution. While compatibility problems could occur if screen or sprite memory were defined in this range by a program, the possibility is so remote that it is unlikely you'll experience any problems due to the default optimization mode setting.

While the optimization mode can be changed with a few POKE commands (as described in the *Programming* section), we have also defined the **(CONTROL)** ◀ (back-arrow) key combination for easy switching between three of the most useful modes. To do this, just hold down the **(CONTROL)** (or **(CTRL)**) key, then press and release the ◀ (back-arrow) key. Each time you toggle the back-arrow key, a message will be printed on your display to indicate which mode is currently selected. You may only use this function from BASIC direct mode—it will not operate when programs are running on your computer, nor will it operate if you are in quote mode. The available optimization modes differ, depending on whether your computer is in 40-column or (Commodore 128 only) 80-column display mode. The following chart shows which modes are available:

Message	Optimization Mode	Memory Mirrored	40-col.	80-col.
DEFAULT	No Opt. All Memory ZSOFF	\$0:0200-\$1:FFFF	•	•
NONE	No Opt. All Memory ZSON	\$0:0000-\$1:FFFF	•	•
BASIC	BASIC	\$0:0400-\$0:07FF	•	
FULL	Full Optimization	None		•

Mirroring memory from the SuperCPU into the computer is necessary to get proper video data for the VIC chip (the 40-column display chip in the Commodore 64 and 128 computers). Since it isn't possible to determine where the video memory will be (programmers can change the location), the SuperCPU mirrors most of the memory by default to avoid major compatibility problems. Mirroring is a slow process, however, and using optimization modes to reduce mirroring speeds memory access. To help you understand when you should use a given mode, here's a brief description of each:

DEFAULT: Mirrors all memory except Zero Page and Stack. May prove incompatible with programs if sprite data or screen memory is moved into these areas, though such programs are extremely rare. A good general operating mode, since it offers good compatibility under all other circumstances, and provides an extra speed boost.

NONE: Mirrors all memory. This mode offers the highest level of compatibility, but at the cost of some speed. Programs will generally run slower in this mode than in the Default mode, though compatibility is increased slightly.

BASIC: Mirrors only the standard screen RAM. Great for BASIC and machine language programs that use the standard default screen memory for a text-only display. Provides an extra speed boost over the Default mode, though a larger number of programs are incompatible with this mode.

FULL: Doesn't mirror any memory. Great for 80-column mode programs since the VIC chip is not used, while the 80-column VDC chip is written to directly by either the Kernal or the program itself.

JIFFYDOS

The SuperCPU comes with the computer portion of JiffyDOS, referred to as the JiffyDOS Kernal. JiffyDOS provides a wide range of features that make your computer easier to operate, and can also speed access to disk drives. The JiffyDOS switch controls whether JiffyDOS enhanced disk access routines are used. If you do not want to use JiffyDOS, enter the @Q command in BASIC direct mode to disable the JiffyDOS command functions, then move this switch to the Disable position, or reset your computer with the JiffyDOS switch in the Disable position.

To take advantage of the speed enhancements, you'll need to use JiffyDOS-equipped or JiffyDOS-ready disk drives. CMD has JiffyDOS ROMs for most drives, and manufactures JiffyDOS-ready FD Series floppy drives and HD Series hard drives. You aren't required to use JiffyDOS-equipped drives with the SuperCPU, but doing so will allow you to get the most out of your system since the SuperCPU alone cannot enhance drive performance.

A summary of JiffyDOS commands has been included in this manual to assist you in using JiffyDOS. You may also obtain a complete JiffyDOS manual from CMD if you feel you need one. Many users will find the summary adequate, but here are some of the most helpful JiffyDOS functions to help you get started:

(CONTROL) (D) This JiffyDOS function sequences through the active drives on your system, letting you select the drive with which you wish to use the JiffyDOS commands. To use this function, hold down the **(CONTROL)** key while you press and release the **(D)** key. Release the **(CONTROL)** key afterward. You'll see a number appear on your screen during this process. This number indicates the current default drive. Each time you repeat this process, JiffyDOS will increment the default drive selection to the next available drive on your system, eventually ending back up at the drive where you began. Using this function will simplify using other JiffyDOS commands with all the drives on your system, since JiffyDOS will send the commands to the current default drive unless you specify otherwise. *Note: This function only works in BASIC direct command mode—you can't use it while running a program.*

(F1) This function lets you view the directory of the current default drive. To use this function, select the drive you want to view the directory of using the **(CONTROL) (D)** function. Now press the **(F1)** function key. JiffyDOS will read and display the directory. This function is non-destructive—it won't affect programs that you have in memory. *Note: This function only works in BASIC direct command mode—you can't use it while running a program.*

(@) The 'commercial at' is used to provide a wide range of standard DOS Wedge and special JiffyDOS commands. Used alone, this command instructs the computer to read and display the error channel of the default drive. To do this, press the **(@)** key, then press **(RETURN)**.

You can also use the **(@)** key to perform almost any disk command, such as the Scratch or New (format) commands, and even the Change Partition (CP) command used by CMD devices like RAMLink. For example, entering the command, "@CP3" on a CMD device would select partition number 3.

If the drive you want to send a command to isn't the current default, you can switch using **(CONTROL) (D)** or you can direct the command to go to a different device. To do the latter, place the command string in quotation marks, then add a comma and the device number to which you want to send the command. For example, to Scratch the file "HELLO" from device 9, just type:

@ "S:HELLO" , 9

and press **(RETURN)**. *Note: This function works in direct command mode and can also be used in BASIC programs.*

For more information on JiffyDOS commands, see the *JiffyDOS Command Summary*.

TESTING SOFTWARE

There are some guidelines which you can follow when attempting to get specific programs to work with the SuperCPU. Generally you'll want to try using the software with the SuperCPU enabled and in Turbo mode, and with JiffyDOS enabled as well. Should the program fail to load or operate, however, try the program again after performing one of the following steps:

- Use the **(CONTROL)** ← function to switch optimization to NONE
- Disable JiffyDOS commands by typing @Q **(RETURN)**
- Disable JiffyDOS on your disk drive only (if possible)
- Disable JiffyDOS via the switch on the SuperCPU only
- Disable JiffyDOS via the switch on the SuperCPU and on your disk drive
- Disable Turbo mode by placing the speed switch in Normal mode, but enable JiffyDOS on the SuperCPU and your drive
- Try each of the various combinations of disabling JiffyDOS listed above with Turbo mode disabled
- Disable the SuperCPU entirely by moving the Unit switch to Disable

If after trying all of the combinations your software still doesn't work, then the cause of the problem is probably something other than the SuperCPU.

There are a few common causes when programs fail to work with the SuperCPU, and we've outlined these for you below:

- An incompatibility with the JiffyDOS command wedge, Kernel, or drive ROM
- Disk routines that bypass the Kernel ROM and attempt to perform custom high-speed drive access routines
- Previously unimplemented opcodes are being used (the new high-speed processor used in the SuperCPU has an extended instruction set and will produce unexpected results when unimplemented 6502 opcodes are used)
- A certain hardware characteristic of the Commodore computer is not fully emulated by the SuperCPU (we won't discount the possibility).

In addition, there could be any of several reasons why programs may exhibit annoying side-effects, or may not work in a desirable fashion with the SuperCPU in Turbo mode. Most commonly, programs may use software timing loops which assume that the processor is running at stock speeds to determine when specific functions should occur. This can cause any number of problems: annoyingly fast cursor blinking, screens that clear before you can read what's on them, input routines that run so fast that a single input is mistaken for multiple inputs, modem routines that don't time correctly due to custom RS-232 timing, and programs that appear to lock up (usually they're just waiting too short of a period of time for something to occur). The only thing you can do about these programs is modify them yourself to correct the problems (if it's possible to do so), or switch the SuperCPU's Speed to Normal.

WHAT WORKS?

This manual couldn't be considered complete without giving consideration to what does (and what does not) work with the SuperCPU. We have broken most of this information down by program category to assist you in quickly finding out about specific program types. But before that, there is one general compatibility issue to be covered.

Any program that tries to copy the Kernal ROM into RAM and execute it from there will fail. This is because the SuperCPU Kernal is multi-layered, and the mechanism that allows this to work will fail with the Kernal itself switched out. Luckily, this practice is rarely found in programs, since it wastes resources.

The following paragraphs key in on both general and specific examples of what does and does not work, and why.

GAME PROGRAMS

Games are probably the least compatible category of programs to use on an accelerated system. Despite this, we've found that a lot of games are indeed compatible with the SuperCPU's Turbo mode. Many games use 'raster interrupt' programming to time events, and since the VIC chip runs at the same speed it always has, this method works well.

We've also found a few games that aren't compatible with Turbo mode. Generally, games that use custom fastloader routines that bypass the Kernal will fail to load correctly. With respect to these particular types of games, you may be able to switch to Normal speed while loading, then switch back to Turbo mode once the game has started running. If the game goes back to disk for additional modules, though, there's a possibility of failure. Flight Simulator II is a prime example of this. You can load it using Normal speed, then switch to Turbo mode and start flying. But once you cross over into a new area where the program requires data to be loaded in from the disk—crash! (The program, not the plane!)

Many games may run too fast to be playable in Turbo mode, too (Frogger illustrates this). Speed kills. On the other hand, we tried quite a few old BASIC game programs that used to be boringly slow, and suddenly they were kind of fun to play.

You might also find an occasional game that won't work at all with the SuperCPU enabled. These games may use previously undefined opcodes, jump directly into ROM routines that have been altered, or are use timing tricks that are beyond the ability of the SuperCPU to emulate (the latter should be extremely rare). While we haven't found any games that fall into these categories yet, almost certainly they do exist.

PRODUCTIVITY PROGRAMS

Nearly all productivity software should work with the SuperCPU. You may find some that have initial fastloaders that bypass the Kernal routines, but this is pretty uncommon in this type of program. Even so, these programs usually allow you to disable the fastload feature, or you can switch the SuperCPU to Normal for loading and switch back once it's done loading. *Notes: Superbase 128 and Superscript 128 have illegal opcodes in their loaders, and will not load with the SuperCPU*

enabled. Cadpak 128 and Chartpak 128 will only operate at Normal speed due to odd timing in their custom interrupt routines.

BASIC PROGRAMS

BASIC programs generally work quite well with the SuperCPU, but you should expect to run into routines where input is too fast, or screens don't display long enough. If you write your own BASIC programs, you can easily make sure that these problems are avoided by writing routines that work well at any speed, or by checking for the presence and speed of a SuperCPU and adjusting the timed routines accordingly (see the *Technical Information* section).

DISK UTILITIES & COPY PROGRAMS

This category covers a wide range of programs, but those which are of most concern from a compatibility standpoint are disk copiers and archivers, such as Maverick or Fast Hack'em. Programs of this type will generally at least require setting the Speed switch to Normal mode, and some may require disabling the SuperCPU altogether. However, more generic file copiers should operate in Turbo mode. However, the more efficient the copier, the less likely you are to see any real performance increases (since all disk access takes place at 1 MHz). *Note: CMD's MCOPY, BCOPY and BCOPY+ require using Normal mode due to timed delay routines used to get the copy process started.*

TERMINAL/BBS PROGRAMS

Relatively few programs in this category have been tested directly by CMD. One area of concern would be custom RS-232 routines, which might be created in a manner that would cause them to be dependent upon the timing of a stock processor. If so, these could fail at high speed. On the other hand, programs that use SwiftLink or Turbo232 interfaces need not perform any RS-232 timing, and are more likely to operate. *Notes: Novaterm author Nick Rossi has upgraded Novaterm 9.6 to take advantage of the SuperCPU's optimization capabilities.*

CP/M

Sorry, but you'll need to disable the SuperCPU when you want to boot CP/M.

HARDWARE COMPATIBILITY

The SuperCPU will work with a wide variety of hardware add-ons including many of the cartridges intended for use in the Cartridge/Expansion (game) port. One important note: **due to a drawback in Commodore's design, the SuperCPU 64 does not support using the 80-column VDC screen on Commodore 128 computers operating in 64 mode.** The SuperCPU 128 can perform this function, provided the MMU SuperAdapter is installed.

I/O CARTRIDGES

Most cartridges that do not contain ROM should work correctly. Some common examples of this would be the SID Symphony Stereo cartridge and the SwiftLink and Turbo232 modem interface cartridges.

ROM CARTRIDGES

Some ROM cartridges will work with the SuperCPU, including many game and some utility cartridges. When these are detected, the SuperCPU automatically slows down to read from the cartridge's memory (the chips used in these cartridges are much too slow to keep up with the SuperCPU).

Cartridges that use the 'Ultimax' memory map will not work with the SuperCPU. This mode is selected when a cartridge pulls the GAME line low with the EXROM line set high on the cartridge port. Cartridges that use this mode include Action/Replay, Super Snapshot, Partner 64, most IEEE interface cartridges, the Lt. Kernal hard drive host adapter, and some game cartridges. Due to the way these cartridges replace the Kernal, they would render the SuperCPU inoperable even if they were otherwise compatible. To use these cartridges, you'll most likely need to disable the SuperCPU.

RAM EXPANDERS

The SuperCPU is fully compatible with several different RAM expansion devices. RAM devices can provide you with the ability for the fastest possible operation when used with the SuperCPU and compatible software. The following breakdown indicates which devices work with the SuperCPU:

RAMLink - You'll find that the SuperCPU enhances the performance of RAMLink itself, including hard drive access provided through the RAMLink's parallel port. In addition, all of the RAMLink switches still operate just as they normally would without a SuperCPU. RAMLink and a CMD HD combined with a SuperCPU give you the most powerful Commodore system possible.

Commodore & CMD 17xx Series REU's & the SSI 1750 Clone - These DMA devices are fully compatible with the SuperCPU. Programs do not need to slow the SuperCPU down to 1 MHz for REU access, as the SuperCPU itself automatically detects DMA transfers and controls the speed as needed.

GeoRAM & BBGRAM - These devices are compatible with the SuperCPU, and will operate just as they normally do.

RAMDrive - This device is not compatible with the SuperCPU, as it would require rewriting the RD-DOS and incorporating that directly into the SuperCPU.

Quick Brown Boxes - Testing has been done with the Commodore 64 version of QBB (latest release) and it appears to be compatible. There may be some conflicts with JiffyDOS commands, though we haven't experienced any. The 128 version of QBB has not been tested at this time.

USER PORT & SERIAL BUS DEVICES

Typically, all devices that attach to the User Port or Serial Bus should continue to be compatible when using the SuperCPU, provided they are used with compatible software. This includes such devices as Commodore-compatible modems, RS-232 interfaces and geoCable for the User Port, and disk drives, printers and parallel printer interfaces for the serial port.

INSTALLING & USING GEOS

GENERAL

The disk supplied with your SuperCPU contains the SuperInstall program, which patches GEOS 64 and 128 boot disks to operate with the SuperCPU. **IMPORTANT:** *SuperInstall will only operate correctly if used with GEOS 64 version 2.0, GEOS 64 version 2.0r, GEOS 128 v2.0 or GEOS 128 v2.0r. If you do not have a 2.0 or a 2.0r version of GEOS, you may wish to obtain it directly from CMD or an authorized dealer.*

In addition to the SuperInstall utility, we have included new versions of CONFIGURE (64CONFIG 2.1s), RBOOT (SRBOOT) and the calculator. **IMPORTANT:** *These programs are for GEOS 64 v2.0 only.* The 64CONFIG 2.1s and SRBOOT programs will let you use the SuperRAM as a GEOS RAM disk; the Calculator program corrects a bug that caused the program to crash when using any accelerator.

Additional patches for using SuperRAM with GEOS 128 are currently being developed, and will be made available to SuperCPU 128 owners as soon as they are ready to ship. **NOTE:** *If you purchased your SuperCPU 128 from a dealer, your dealer will be notified of the availability, and will be able to procure the update for you.*

INSTALLATION

Before you begin this installation, it is presumed that you have already installed and used the SuperCPU with your computer system, and have made sure that it works properly. If you have not done this, do so now before performing this procedure.

Assuming you have the correct version of GEOS, you may proceed with the installation procedure below. The procedure may be accomplished using either a single disk drive, or a system with multiple drives. The main point of each step has been set in bold type so that expert users can work quickly through the procedure. Novice users may find the additional information helpful. Notes set in *italics* are important to every user, so please be sure to read them. **NOTE:** *Installation requires up to 17 blocks (5K). Make sure your boot disk has sufficient free space before you begin the installation!*

PROCEDURE

- ▶ Turn on your computer.
- ▶ If your SuperCPU is enabled, set the Speed switch to Normal.
- ▶ Boot GEOS using either a standard GEOS boot disk, or a GEOS boot disk created with geoMakeBoot. **NOTE:** *The patch program may also work with GEOS boot disks created by other means, but we cannot guarantee this.*
- ▶ After GEOS has completed booting, insert the SuperCPU Utilities disk into any drive on your system that is active under GEOS. If you are using a single drive, you'll need to remove your boot disk and insert the SuperCPU Utilities disk into that drive.

- ▶ Using your input device, position the tip of the pointer on the middle of the disk icon for the drive containing the SuperCPU Utilities disk. **Click once on the disk icon to open the disk** and display its contents on the desktop.
- ▶ Locate the SuperInstall icon on the desktop and position the tip of your pointer on the middle of it. **Start the SuperInstall application** by double-clicking on its icon.
- ▶ When the SuperInstall application screen appears, **click once on the Install SuperCPU icon** to bring up the installation options.
- ▶ SuperInstall will automatically select the options necessary to modify your 'GEOS' boot file and create the SUPERGEOS auto-exec file. It will also determine if you're using a CMD SmartMouse, and select the option to create the SuperSmart driver if you are. If you're using some other mouse, SuperInstall will instead default to the option that creates a Super1351 mouse driver. If you have only a joystick, no driver will be selected. **Check to see that the selected options are correct for your system.** If you need to change any of the options, just click once on the checkbox to the left of the option you want to change.
- ▶ SuperInstall also detects your drive configuration automatically, and shows the available drives in the drive selection box located in the lower-left corner of the options screen. **Click once on the drive selection button that matches the drive you want to perform the installation on.** You can skip this step if the drive you want to install on is already selected (the selected drive button will be a mixture of blue and cyan instead of blue and white).
- ▶ **Click once on the INSTALL button.**
- ▶ SuperInstall will present a dialog asking you to **insert the boot disk you wish to install on into the drive you selected.** Insert the disk now (*make sure the disk is not write protected!*), and **click once on the OK button.** SuperInstall will now begin the installation, and will keep you informed of what it is doing as it installs the selected options. It will also warn you if it encounters any errors.
- ▶ After SuperInstall has finished its work, it will inform you of this, and that you may now reboot GEOS. To acknowledge this, **click once on the OK button.**
- ▶ SuperInstall will now return to the options screen in case you want to perform installations on additional boot disks. If you do, repeat the required steps. **When you are finished installing, click once on the EXIT button on the options screen.**
- ▶ Once you've returned to the GEOS desktop, check to **make sure that the new files (SUPERGEOS and optionally SuperSmart64 and/or Super1351_64) have been installed.** Also, **make sure that SUPERGEOS is the first auto-exec on the disk, and if a Super mouse driver was installed, make sure it is the first input driver on the disk.** If these files aren't the first of their type, you can swap files manually to make sure that they are. If you don't know how to swap files, see 'Moving File Icons' in Chapter 3 of your GEOS manual. *NOTE: Failure to make SUPERGEOS the first auto-exec may cause problems with the operation of GEOS.*
- ▶ After you have verified that the files are correctly placed on your boot disk, **exit GEOS and turn off your computer.**

NOTE: SuperInstall attempts to patch your GEOS boot file. If it fails to recognize your GEOS file as a standard type, it will abort this process and warn you to issue a POKE 53370,0 before booting GEOS. This must be done each time you boot GEOS. Optionally, you could set the Speed switch to Normal while booting GEOS, then set it to Turbo once GEOS is running.

BOOTING GEOS

To boot GEOS, turn on your computer, set the SuperCPU's Speed switch to Turbo, and follow the normal steps using the boot disk you have installed the patches on. *NOTE: If SuperInstall reported that your GEOS file was not compatible with the patches, you'll need to issue a POKE 53370,0 command before booting GEOS. Optionally, you could instead set the SuperCPU's Speed switch to Normal while booting, then switch it to Turbo once GEOS is running.*

SUPERGEOS AS AN APPLICATION

While SUPERGEOS functions mainly as an auto-exec that installs SuperCPU patches during the boot process, it can also be run as an application. To do this, locate the SUPERGEOS icon, position the tip of your pointer in the middle of the icon, and then double-click. What you'll see is a representation of the SuperCPU front panel controls, but with one additional switch on the far right, labelled 'GEOS OPTIMIZE'.

While the UNIT and JIFFYDOS switches shown on the displayed control panel do nothing, clicking on SPEED or GEOS OPTIMIZE switches changes these functions within the SuperCPU itself (as well as on the screen). This control panel can thus be used to change the speed of your SuperCPU, or to disable the GEOS Optimization mode which is normally turned on while booting.

Turning off GEOS Optimization mode may become necessary with GEOS applications that do not use the standard GEOS bit-mapped screen. This has been found to be true of GEOBASIC, which uses a standard text screen for program entry. While your bit-mapped GEOBASIC applications that you create should work fine with GEOS Optimization mode enabled, you'll need to disable the mode while writing or editing such programs in GEOBASIC itself. We're not yet aware of any other applications that require this mode to be disabled, but they certainly may exist. What you'll normally see after booting such a program is a static copy of the BASIC screen as it looked when you began booting GEOS. If this happens, you'll need to reboot GEOS, then turn off GEOS Optimization mode using SUPERGEOS before booting the conflicting program.

SUPER MOUSE DRIVERS

The two Super mouse drivers have been specially designed to make mouse input devices operate smoothly at high speed. You may sometimes find that the speed of your enhanced system makes selecting items difficult. As a work-around, one of the mouse buttons has been programmed to switch Turbo off while the button is held down. The following shows the button assignments for the two drivers:

	SuperSmart Driver	Super1351 Driver
Left Button	Turbo Single-click	Turbo Single-click
Center Button	Normal Single-click	N/A
Right Button	Turbo Double-click	Normal Single-click

64CONFIG 2.1s

This file is only used with the CMD SuperCPU with a populated SuperRAM card installed, and will only work with US or German GEOS 64 v2.0 (this CONFIGURE file will *not* work with any GEORAM version of GEOS). It allows GEOS to use up to approximately 2 Megabytes of RAM (from the SuperRAM card) to create RAM disks. This version of CONFIGURE also recognizes CMD HD and CMD FD drives, but will *not* recognize a RAMLink or any other RAM device. The recommended steps for replacing your CONFIGURE file are as follows:

- ▶ Install your SuperRAM card if you haven't already done so
- ▶ Patch your GEOS boot disk with SuperInstall to use the SuperCPU if you haven't already done so
- ▶ Boot GEOS with only 1 disk drive (device 8) attached
- ▶ Locate the CONFIGURE file on your boot disk
- ▶ Center the pointer over the icon for your CONFIGURE program, and click once to select it
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Move the pointer until it points into the deskTop's bottom border area (between the printer icon and the trash can icon)
- ▶ Click once in this area to deposit the CONFIGURE icon into the border
- ▶ After the disk activity stops, click once on the CONFIGURE icon to select it again
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Center your pointer over the trash can and click once
- ▶ Remove your GEOS boot disk, and insert the SuperCPU Utilities disk in your drive
- ▶ Click once on the drive A icon to open the disk
- ▶ Locate and click once on the 64CONFIG 2.1s file icon
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Move the pointer until it points into the deskTop's bottom border area (between the printer icon and the trash can icon)
- ▶ Click once in this area to deposit the 64CONFIG 2.1s icon into the border
- ▶ When your pointer reappears and all disk activity has stopped on your disk drive, remove the SuperCPU Utilities disk and insert your boot disk
- ▶ Click once on the drive A icon to open the disk
- ▶ Click once on the 64CONFIG 2.1s icon (located in the border) to select it
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Move your pointer until its point is centered over the file note pad area (the area where file icons normally appear)
- ▶ Click once in this area to start the file copy procedure
- ▶ Follow the prompts provided for disk swaps to complete the copy procedure
- ▶ After the procedure is complete, insert the SuperCPU Utilities disk into your drive
- ▶ Click once on the 64CONFIG 2.1s file icon located in the border
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Move the pointer until its point is centered over the file note pad
- ▶ Click once to deposit the file icon back onto the file note pad
- ▶ Exit from GEOS and turn off your computer

You may now configure your system according to your needs. If you need to, refer to the section *Using More than One Disk Drive* in your GEOS 2.0 manual (pg. 77), and take note of the differences and tips provided below.

- If you use only one physical disk drive, you may have up to two RAM disks
- You may have only one RAM disk if you use two physical drives
- You may not have a RAM disk if you have three physical drives (device numbers 8, 9 and 10), but all three drives can be on the deskTop at once
- While in CONFIGURE (64CONFIG 2.1s), either drive a or drive b *must* be a real (physical) disk drive or you won't be able to exit the program
- If you set up two RAM disks of the same type, be sure to rename one of them immediately, or GEOS could become confused and corrupt one or both
- The *Shadow 1581 Dir* option no longer appears, as the HD/FD version of the 1581 driver does not support this function
- There is no *DMA for MoveData* option, since the SuperRAM doesn't use a DMA controller
- Be sure to save your configuration, and copy this version of CONFIGURE (64CONFIG 2.1s) to other disks you use which contain different versions.

SRBOOT

This file is only used in conjunction with GEOS 64 v2.0 and 64CONFIG 2.1s. SRBOOT lets you reboot GEOS from your RAM, provided you haven't turned your computer off or overwritten the RAM. The recommended steps for replacing your old RBOOT file with SRBOOT are as follows:

- ▶ Boot GEOS with only 1 disk drive (device 8) attached
- ▶ Locate the RBOOT file on your boot disk
- ▶ Center the pointer over the RBOOT program's icon, and click once to select it
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Move the pointer until it points into the deskTop's bottom border area (between the printer icon and the trash can icon)
- ▶ Click once in this area to deposit the RBOOT icon into the border
- ▶ After the disk activity stops, click once on the RBOOT icon to select it again
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Center your pointer over the trash can and click once
- ▶ Remove your GEOS boot disk, and insert the SuperCPU Utilities disk in your drive
- ▶ Click once on the drive A icon to open the disk
- ▶ Locate and click once on the SRBOOT file icon
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Move the pointer until it points into the deskTop's bottom border area (between the printer icon and the trash can icon)
- ▶ Click once in this area to deposit the SRBOOT icon into the border
- ▶ When your pointer reappears and all disk activity has stopped on your disk drive, remove the SuperCPU Utilities disk and insert your boot disk
- ▶ Click once on the drive A icon to open the disk

- ▶ Click once on the SRBOOT icon (located in the border) to select it
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Move your pointer until its point is centered over the file note pad area (the area where file icons normally appear)
- ▶ Click once in this area to start the file copy procedure
- ▶ Follow the prompts provided for disk swaps to complete the copy procedure
- ▶ After the procedure is complete, insert the SuperCPU Utilities disk into your drive
- ▶ Click once on the SRBOOT file icon located in the border
- ▶ Pause, then click a second time to attach the icon to your pointer
- ▶ Move the pointer until its point is centered over the file note pad
- ▶ Click once to deposit the file icon back onto the file note pad

To use the SRBOOT file, make sure you have the RAM Reboot option selected in CONFIGURE (64CONFIG 2.1s), then exit from GEOS using the BASIC option in the options menu. Insert a disk containing SRBOOT into any active drive and load it. If you were using device 8, you would load the file by typing:

LOAD "SRBOOT", 8

Be sure to press the **(RETURN)** key to start the load process. When the READY prompt appears, type RUN and press **(RETURN)**. GEOS will be rebooted from the RAM. This program will only work correctly if (a) your computer's power hasn't been interrupted since you exited GEOS; (b) your devices are set up using the same device numbers as they had when you last exited from GEOS, and (c) nothing has overwritten the GEOS Kernel that resides in the SuperRAM card memory.

calculator

This is an updated version of the calculator desk accessory that is provided with GEOS 64 v2.0. The standard version has a bug that can cause a system crash on accelerated systems when math functions are called. The version supplied here fixes that bug, and should be used to replace your original. This new version will work fine whether you're using acceleration or not. Use standard copying procedures as outlined in your GEOS manual to copy this to your work disks.

ADDITIONAL NOTES ON GEOS

Due to the use of the GEOS Optimization mode built into the SuperCPU, GEOS applications are able to operate at a highly efficient speed. In addition, thanks to the expertise of GEOS programmer Maurice Randall, the provided GEOS patches deliver an extremely high level of compatibility. GEOS programmers, however, just like many other Commodore programmers, don't always follow conventional standards—even Geoworks' (formerly Berkeley SoftWorks) programmers would occasionally throw caution to the wind and break some of their own guidelines in writing GEOS applications. While every attempt has been made to assure that things will work smoothly, there are bound to be some oddities lurking about. The SuperCPU enables GEOS to run at speeds many times faster than the original authors could have ever foreseen possible. If you do run into a problem, we'd like to hear

about it. While we can't guarantee every problem can be resolved, we will investigate and attempt to duplicate and resolve all problems which are reported and properly documented.

That aside, the following are a few notes about various GEOS attributes with respect to the SuperCPU and SUPERGEOS patches:

- After installing the GEOS patches on your boot disk, it can still be used to boot your system without a SuperCPU as well as with one.
- The GEOS patches can be applied to GEOS boot partitions on CMD devices that were created with geoMakeBoot.
- For guaranteed results, the GEOS patches should only be applied to original GEOS boot disks and disks or partitions created with geoMakeBoot. Other boot disk creation methods may be compatible, but we cannot guarantee your results.
- You shouldn't create geoMakeBoot disks after booting from a patched disk. Boot with a stock GEOS disk, create a geoMakeBoot boot disk, and then apply the patches to the newly created boot disk.
- SUPERGEOS should always appear on your boot disk before Configure, especially if you use a RAM device with the RAM Reboot option selected.
- A portion of the GEOS patches reside in the SuperCPU itself, in a new RAM area reserved for system use. If a program happens to trash that area, you may experience problems performing a RAM reboot (RBOOT) using power- or battery-backed RAM devices. The odds of this happening are slim, but it's possible.
- To avoid areas that other programmers might use within applications, the GEOS Kernel routine "ToBASIC" has been patched and partially relocated into the SuperCPU. We don't expect this to create any compatibility problems, but programmers may want to be aware of this.
- The GEOS patches applied to the "ToBASIC" routine also make GEOS perform a better reset. This means that all JillyDOS commands work correctly now when exiting from GEOS. Programs such as 'CleanReset 64' are no longer required.

TECHNICAL INFORMATION

MEMORY DIFFERENCES

Due to the very nature of what the SuperCPU is and does, there are differences in portions of your computer's memory map when the SuperCPU is enabled. These differences fall into two main segments of memory: the I/O area, where the SuperCPU registers are located; and the Kernel, which has been patched out of necessity.

Within the I/O space, there are three specific ranges of memory that are affected: \$D070-\$D07F; \$D0B0-\$D0BF; and \$D200-\$D3FF.

SUPERCPU REGISTERS

All registers are located in VIC register mirror locations. On a stock system, reading these locations always returns an \$FF, and writing these locations does not fall through into RAM while I/O is switched in. Therefore, these locations are generally considered useless on a stock system when I/O is switched in.

The registers in the \$D07x range and some of the flags in the \$D0Bx range are write-sensitive switches. In other words, any write (POKE or machine language 'store' operation) to a register in that range will cause the register's assigned function to activate, regardless of the value being written into the location.

Also note that the new registers have been created using a 'sandwich' assignment that minimizes the chances of memory fill problems. In other words, a memory fill might trigger a slowdown when writing to the register that provides this capability; however, the very next location written to in either direction causes a speed-up, so the SuperCPU could only be slowed down inadvertently for the duration of one machine instruction. The same situation applies to the hardware enable and disable registers: the locations on either side of the hardware enable register is a hardware disable register. Therefore, memory fills in either direction could only inadvertently enable the hardware for one machine instruction operation. Programmers should use the documented locations and not the duplicates.

RESERVED REGISTER LOCATIONS

In addition to the documented registers, there are undocumented locations in both the \$D07x and \$D0Bx ranges which are reserved for system use only. These locations are only active while the SuperCPU's hardware registers are enabled. **Do not write to undocumented locations in these ranges while the hardware registers are enabled.**

DETECTING A SUPERCPU

There are several possible methods to detect the presence of a SuperCPU on a computer. One of the more simple methods would be to check bit 7 of \$D0BC. On a stock 64, this bit would always be high (logic 1), but on a SuperCPU it will normally be set to 0 whenever a user program is in control. The following BASIC program checks this bit and determines whether a SuperCPU is present and enabled:

Important SuperCPU Memory Locations

Location	Purpose
\$D074 ¹ (53364)	VIC Bank 2/GEOS Optimization (mirror \$8000-\$BFFF)
\$D075 ¹ (53365)	VIC Bank 1 Optimization (mirror \$4000-\$7FFF)
\$D076 ¹ (53366)	BASIC Optimization (mirror \$0400-\$07FF)
\$D077 ¹ (53367)	No Optimization (mirror all memory) (v1 default)
\$D07A ² (53370)	Software Speed Select - Normal (1 MHz or 2 MHz in 128 Fast mode)
\$D07B ³ (53371)	Software Speed Select - Turbo (20 MHz) (*\$D079)
\$D07E ² (53374)	Hardware Register Enable
\$D07F ² (53375)	Hardware Register Disable (*\$D07D)
\$D0B0 ⁴ (53424)	SuperCPU Mode Detect Register 00xxxxxx = SuperCPU v2 in 128 mode 01xxxxxx = SuperCPU v2 in 64 mode 11xxxxxx = SuperCPU v1, no SuperCPU, or SuperCPU disabled
\$D0B2 ⁴ (53426)	Bit 7: Hardware Register Enable Flag (1=Enabled) Bit 6: System 1 MHz Flag (1=Enabled)
\$D0B3 ^{5,7} (53427)	Enhanced Optimization Register (v2 only, see <i>Version 2 Options</i>) 00xxx1B2 = VIC Bank 0, \$0000-\$3FFF 01xxx0B0 = VIC Bank 1, \$4000-\$7FFF 00xxx0B0 = VIC Bank 2/GEOS, \$8000-\$BFFF 01xxx1B0 = VIC Bank 3, \$C000-\$FFFF 10xxx0B0 = BASIC Opt., \$0400-\$07FF 11xxx002 = No Opt. All Mem., \$0:0000-\$1:FFFF (v2 default) 11xxx1B2 = No Opt. per Bank, \$0000-\$FFFF 10xxx100 = Full Optimization (no mirroring of any memory)
\$D0B4 ⁵ (53428)	Bits 7 & 6: Optimization Mode Flags: 00xxxxxx = VIC Bank 2/GEOS Optimization Enabled 01xxxxxx = VIC Bank 1 Optimization Enabled 10xxxxxx = BASIC Optimization Enabled 11xxxxxx = No Optimization
\$D0B5 ⁶ (53429)	Bit 7: JiffyDOS Switch Flag (1=Enabled)
\$D0B6 ⁶ (53430)	Bit 6: Speed Switch Flag (1=Normal, 0=Turbo)
\$D0B8 ⁶ (53432)	Bit 7: Processor Emulation Mode Flag (1=Emulation) Bit 6: Reset Switch Flag (1=Switch pressed) (v1 only)
\$D0BC ⁵ (53436)	Bit 7: Software Speed Flag (1=Normal, 0=Turbo) Bit 6: Master Speed Flag (1=Normal via any source) Bit 7: DOS Extension Mode Flag (1=Enabled) Bit 6: RAMLink Hardware Registers Flag (1=Enabled)
\$D200-\$D2FF ⁴	System RAM (53760-54015)
\$D300-\$D3FF ⁵	User RAM (available for user programs) (54016-54271)

Notes:

- ¹ Write only, hardware registers must be enabled to activate location.
- ² Write only, active with hardware registers enabled or disabled.
- ³ Write only, active with hardware registers enabled or disabled, but does not over-ride hardware Speed switch.
- ⁴ Read only with hardware registers disabled, Read/Write with hardware registers enabled, write access reserved for system only.
- ⁵ Read only with hardware registers disabled, Read/Write with hardware registers enabled.
- ⁶ Read only with hardware registers enabled or disabled (write with hardware registers enabled has no effect).
- ⁷ Changing values in this area affects all other optimization mode registers, and changing other optimization mode registers affect this location. The B flag assigns control of this register to a specific Commodore 128 Bank (0=Bank 0, 1=Bank 1), while the Z flag controls mirroring of Zero Page and Stack memory (\$0000—\$01FF) (0=mirroring on, 1=mirroring off). Default for Z is 1, B is 0.
- * Denotes a duplicate register location.

IMPORTANT NOTE: Enabling the SuperCPU hardware registers also causes some changes in the Kernel ROM memory map (\$E000-\$FFFF). To avoid problems, do not leave the hardware registers enabled any longer than necessary. Also note that mirroring of I/O is always performed when I/O is mapped in.

```

100 X=ABS ( (PEEK (53433) AND128) =128)
110 IF X=0 THEN PRINT "SUPERCPU ENABLED"
120 IF X=1 THEN PRINT "SUPERCPU NOT DETECTED" : END

```

Once you have determined if a SuperCPU is present or not, you may also need to know whether it has version 1 or version 2 hardware support. This would be necessary if you plan to use features only available in one version or the other. Reading from location \$D0B0 will provide this information, and will also let you know what mode the SuperCPU is in if it has version 2 hardware. Add these lines to the code above for a complete example:

```

130 V=PEEK (53424) AND192
140 IF V=0 THEN PRINT "SUPERCPU V2 IN 128 MODE"
150 IF V=64 THEN PRINT "SUPERCPU V2 IN 64 MODE"
160 IF V=192 THEN PRINT "SUPERCPU V1" : REM X=0

```

SOFTWARE SPEED CONTROL

When writing or modifying BASIC programs, you can easily control the speed using POKE commands. This might be desirable if you have a program with fixed timing loops, such as FOR/NEXT delays. To slow down a program, you would use POKE 53370, 0. Likewise, to speed the program back up, use POKE 53371, 0. Here's a programming example:

```

100 POKE 53370,0           : REM SLOW DOWN TO 1 MHZ
110 FOR I = 1 TO 1000      : REM FOR/NEXT TIMING LOOP
120 NEXT                   : REM FOR/NEXT TIMING LOOP
130 POKE 53371,0          : REM SPEED UP TO 20 MHZ

```

OPTIMIZING PROGRAMS

The optimization modes supply a means by which programmers, and in some cases users, can optimize their software to operate as quickly as possible. The advantage gained by optimization can be dramatic—a simple FOR/NEXT loop in BASIC may execute more than twice as fast in one optimization mode versus another. Normally the SuperCPU needs to copy all of its own fast RAM contents into the slower RAM of the computer since it doesn't know where the VIC will be getting data from. If you know the VIC data requirements for a specific program, however, you can limit the amount of memory mirroring. To do so, you must enter three POKE commands: one to enable the hardware registers of the SuperCPU, a second to select the optimization mode, and a third to disable the hardware registers of the SuperCPU.

For example, to optimize a program that uses the standard text screen memory (\$0400-\$07FF) for the VIC, you would use the BASIC Optimization mode. To do this, load the program, but before running it enter:

```
POKE53374,0:POKE53366,0:POKE53375,0 : REM V1 OR V2
```

If you have a version 2 SuperCPU, you may also perform this particular mode change using the **(CONTROL)** ← key sequence, or using these three POKE commands:

POKE53374,0:POKE53427,128:POKE53375,0 : REM V2 ONLY

Similarly, you can use the same methods to select any of the other optimization modes. To set the optimization for a program that uses VIC bank 01 (\$4000-\$7FFF) for screen or bit-mapped graphics, use:

POKE53374,0:POKE53365,0:POKE53375,0 : REM V1 OR V2
POKE53374,0:POKE53427,64:POKE53375,0 : REM V2 ONLY

Note that you won't be able to see what you type after you set this mode, or any other mode that disables mirroring of text screen RAM. To set the optimization for a program that uses VIC bank 02 (\$8000-\$BFFF) for screen or bit-mapped graphics, use:

POKE53374,0:POKE53364,0:POKE53375,0 : REM V1 OR V2
POKE53374,0:POKE53427,0:POKE53375,0 : REM V2 ONLY

To restore the default optimization mode after a program has finished, either reset the SuperCPU, or use these POKE commands:

POKE53374,0:POKE53367,0:POKE53375,0 : REM V1 OR V2
POKE53374,0:POKE53427,193:POKE53375,0 : REM V2 ONLY

You can also use these pokes within your own programs, or programs that you are capable of modifying. Here's an example of a short BASIC program that turns on BASIC Optimization, prints to the screen, then disables optimization before ending:

```
10 POKE53374,0:POKE53366,0:POKE53375,0
20 PRINT CHR$(147);
30 FOR I = 1 TO 20
40 : PRINT "HELLO"
50 NEXT
60 POKE53374,0:POKE53367,0:POKE53375,0
50 END
```

You can also use these methods in machine language programs, but instead of using POKE commands, use one of the store opcodes such as STA, STX or STY to perform the desired change. Assembly code to enable BASIC Optimization might look like this:

```
STA $D07E ; ENABLE HARDWARE REGISTERS
STA $D076 ; SELECT BASIC OPTIMIZATION
STA $D07F ; DISABLE HARDWARE REGISTERS
```

Since the value stored doesn't matter, you needn't worry about the loading the .A, .X, or .Y register before actually performing the store operations. While the above example uses STA, it could have just as easily used any other store opcode.

Version 2 Options

As you may have noted in the memory location table, version 2 hardware supports many more optimization modes than version 1 hardware. This was possible due to the high capacity logic used in the new version. New modes include VIC Banks 0 and 3, No Optimization per Bank, and Full Optimization. Several modes also provide control over Zero Page/Stack mirroring (the Z flag) and, when used on a Commodore 128 in 128 mode, optimization mode Bank selection (the B flag).

When using version 2 optimization modes, please use only approved values. The following values are reserved for possible future upgrades, and should never be used:

00xxx001	00xxx011	01xxx001	01xxx011	01xxx101
01xxx111	10xxx001	10xxx011	10xxx101	10xxx110
10xxx111				

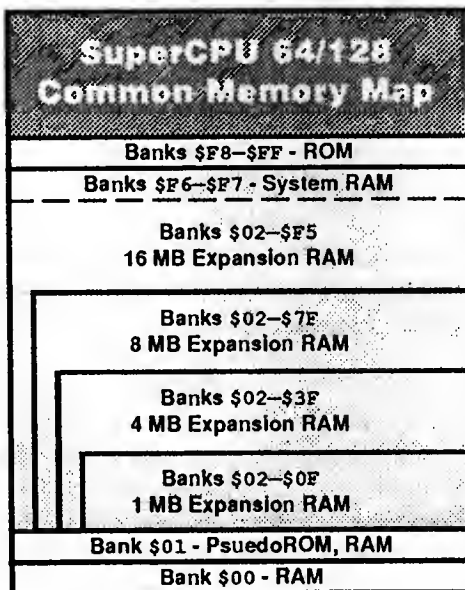
SuperRAM Programming

Since the 65816 processor can address up to 16 Megabytes of RAM, the SuperRAM memory is unlike previous RAM expanders (such as the Commodore and CMD 17xx series REUs or the CMD RAMLink) in that programs can actually execute directly from this memory—provided they are written to do so. It's also important to note that programs don't have to use the 65816 processor's native mode to be able to access this extra RAM (see *SuperRAM Programming Examples*).

For a good overview of how the SuperRAM card fits into the SuperCPU memory scheme, take a look at the *SuperCPU 64/128 Common Memory Map*. The areas in white (Banks \$00, \$01 and \$F8 through \$FF) are found in every SuperCPU, with or without memory expansion. Banks \$00 and \$01 are Static RAM (SRAM), while \$F8 through \$FF are used by or reserved for system ROM. This map is identical on both the 64 and 128 versions of the SuperCPU.

Note: The SuperCPU 128 has two additional banks of 'hidden' SRAM which are swapped in at Banks \$00 and \$01 as needed.

As you can see, there is room for expansion RAM at Banks \$02 through \$F7. Addressing of installed SIMM memory actually begins at \$000000, but since there is Static RAM at these locations, the SIMM RAM Banks \$00 and \$01 have been moved to Banks \$F6 and \$F7 (just below the system ROM), and reserved for future system use. Due to this, the highest Bank available for user programs will be Bank \$F5 (on a system with 16 Megabytes of expansion RAM installed).



Detecting Expansion RAM

Any SuperCPU sold after the SuperRAM card became available has version of the SuperCPU ROM that supports expansion RAM. Also, users with older versions who purchase SuperRAM upgrades are supplied with the new ROM. Thus, the first step in determining if RAM expansion is present is to check the ROM version. This is accomplished by reading four bytes, beginning at \$00E487 in 64 mode or \$00F6DD in 128 mode. These four bytes contain the version number string in PETASCII. The version that provided initial support for expansion RAM is "1.40". Read these bytes and compare for this number. If the version number is lower, there's no expansion; if it's the same or higher, there may be expanded memory, so move on to the next step.

If the first check returns a version that supports RAM expansion, read in four bytes beginning at \$00D27C (this location is the same for both 64 and 128 modes). These bytes contain the following information concerning RAM expansion:

- \$00D27C First Available Page
- \$00D27D Bank of First Available Page
- \$00D27E Last Available Page+1
- \$00D27F Bank of Last Available Page+1

If there isn't any extra RAM installed, all four bytes will contain zeroes. The BASIC program SUPERRAMDETECT (located on the SuperCPU Utilities disk) provides an example of checking these parameters and calculating the available expansion memory. Please note that these variables are only valid in Bank \$00 while I/O is switched in; should you need to check for expansion RAM with I/O out, these values are available in the same locations of Bank \$01.

If your application needs to use some portion of expansion RAM, it must also update the memory variables. This requires switching in the SuperCPU H/W registers by storing any value at \$00D07E (decimal 53374). After you have modified the variables, turn the SuperCPU H/W registers back off by storing any value to \$00D07F (decimal 53375). Again, I/O must be enabled during any of these changes, or you'll need to change the variables directly in Bank \$01.

It is very important that you pay attention to the expansion RAM variables, and that you don't make any assumptions with regard to RAM availability; some future system extensions or user programs may steal some of the RAM before your application is started. As a result, it would be wise to create your program code and/or data segments in a manner that allows them to be relocated.

To assist you in testing routines that detect RAM expansion, we've included the program SUPERRAMFAKE on the SuperCPU Utilities disk. You may use this program to trick your SuperCPU into believing that it has different amounts of RAM expansion available. Naturally you can do this yourself as well by writing bogus values into the RAM pointers, which is what the SUPERRAMFAKE program does.

Speed Considerations

The Dynamic RAM (DRAM) used in SIMMs can't be accessed as fast as the Static RAM (SRAM) used on the SuperCPU main board, but it is far less expensive and available

in larger capacities. Lower cost is why DRAM is used for large capacity expansion memory.

When writing programs on the SuperCPU that use expanded memory, performance may sometimes suffer slightly when accessing DRAM. Try to locate routines that must operate quickly in Static RAM in order to better optimize your programs. Also, when accessing DRAM, try to do so sequentially—the SuperRAM memory controller has been optimized for this. Jumping around a lot or performing non-sequential reads is the cause of most slowdowns. Further details about the speed of expansion RAM and other SuperCPU functions is available in an article published in *Commodore World* magazine, Issue #19.

SuperRAM Programming Examples

The following example shows how 65816 machine language code can easily read and write memory locations above the first Bank (addresses higher than \$FFFF). This type of programming requires using new addressing modes in the 65816 microprocessor.

```
                                ; long read from memory
LDA $01D27C                    ; LDA long

                                ; long write to memory
STA $01D27C                    ; STA long
```

Since pre-existing 6502 assemblers do not support these new addressing modes, you'll need to use some tricks to enter the code. Here's a way to code these on a 6502 assembler:

```
                                ; long read from memory
.BYT $AF                      ; opcode for LDA Absolute Long
.BYT $7C,$D2,$01              ; address in low,mid,high format

                                ; long write to memory
.BYT $8F                      ; opcode for LDA Absolute Long
.BYT $7C,$D2,$01              ; address in low,mid,high format
```

Both LDA and STA also support long addressing for .X indexed operations, and many other opcodes have long addressing modes available. For a complete list of 65816 opcodes, see "A 6502 Programmer's Introduction to the 65816," *Commodore World* magazine, Issue #16, pg. 20.

TROUBLESHOOTING TIPS

Startup Error Messages

When the SuperCPU initializes, it checks for specific hardware problems. If one is found, the message "SUPERCPU INITIALIZATION ERROR" will be displayed, followed by an error number. If you see this message, make note of the error number and contact Technical Support for assistance. Here are the definitions of the possible errors:

- #01 Static RAM failure (Byte Addressing)
- #02 Static RAM failure (Page Addressing)
- #03 Static RAM failure (Zero Page/Stack)
- #04 Kernal/BASIC ROM Checksum Error
- #05 RL-DOS ROM Checksum Error

Initialization Problems

If your computer does not initialize fully, remove any excess cartridges and try again. If you don't have any extra cartridges plugged into your SuperCPU, or if removing them doesn't resolve the problem, turn your computer off and check for problems. The following list provides information on some of the conditions that cause problems.

Inadequate Power

If your power supply is does not provide enough voltage or current, your computer may not initialize fully, may reset, or may not power up at all. Low voltage conditions can also cause erratic or improper operation. Make sure that you're using a heavy-duty power supply if operating on a Commodore 64 computer and note the condition of the power lamp. If possible, try a different power supply. If you are technically inclined and properly equipped to do so, measure the voltage applied to your computer; CMD recommends that applied power be no less than 4.85 volts. *Note: Low voltage conditions can also be caused by dirty contacts in the power switch or power connectors.*

Cartridge Port Connection Problems

There are a wide range of problems associated with the cartridge port. Check the cartridge port connector to make sure that its contacts line up well along the slot opening, and that they are clean and free from foreign substances. If necessary, align and clean the contacts (you can pick up contact cleaning spray from most electronic suppliers, such as Radio Shack). Also check the SuperCPU's edge connector to make sure the contacts are clean and free from foreign substances. Clean if necessary.

Improper MMU SuperAdapter Installation

If you have a Commodore 128 computer with SuperCPU 128 installed, your computer should come up in 128 mode (provided you didn't hold down the Commodore key during

startup); if it doesn't, you may have improperly installed the MMU SuperAdapter. A Commodore 128/SuperCPU 128 combination that does initialize, but without a functional 80-column display could also be an indication of improper MMU SuperAdapter installation.

Improper SIMM or SuperRAM Card Installation

SuperRAM problems may prevent your computer from initializing, cause erratic or improper operation, or may result in improper reporting of expansion RAM capacity. In most cases you can detect SuperRAM problems using the SUPERRAMTEST program, provided your computer boots at all. Make sure the SIMM is properly seated (try re-installing it), and that the contacts on the SIMM and the SIMM socket are clean and in good condition. Make sure the SuperRAM card itself is fully seated, and that it has been installed correctly onto the mating connectors inside your SuperCPU.

Bus Loading/Noise Conditions

Some Commodore computers simply cannot handle having too many items attached to their cartridge port. This may be due to weak bus signals, or to high levels of electrical noise on address, data or control lines. This can create a myriad of symptoms, from screen artifacts (odd characters on the screen where they shouldn't be) to complete failure of the machine to operate. If you suspect you have a loading or noise problem, try to clean and tighten connections to reduce noise levels. If this doesn't resolve the problem, try installing your SuperCPU on a different computer to determine if this is the problem. If you don't have a different machine to try it on, you may want to contact CMD's repair service about troubleshooting the problem for you (this is usually a last resort, since it requires sending the computer and SuperCPU to CMD for evaluation).

SuperCPU/SuperRAM Incompatibility

Some SuperCPU units prior to Revision 1E may not be compatible with the SuperRAM card. This is mainly due to loading characteristics of certain parts that were used in these units. The problem can cause a number of symptoms, such as program freezes, unexpected drops to the BASIC prompt, failure of the SuperCPU to initialize, SRAM failure messages, failure of the SuperRAM Test program, and unexplained resets. CMD has devised an upgrade for the SuperCPU 64 CPLD (Complex Programmable Logic Device) chip that compensates for this problem. If you have a SuperCPU previous to Revision 1E and have tried to resolve symptoms such as those described above without success, you should contact CMD directly about the possibility of needing this upgrade.

Faulty Components in Computer

An otherwise healthy and properly functioning computer may have a faulty chip that only affects the operation of the Cartridge Port. Furthermore, a faulty signal on the cartridge port might only affect the SuperCPU, while other cartridges work properly (the SuperCPU uses more signals and functions than other cartridge port devices do). The PLA is almost always the culprit in these cases. If possible, try another computer to help isolate the problem. *Note: Determining which chip is at fault may require the help of an experienced technician. Replacing faulty chips may involve soldering and should not be attempted by a novice.*

NOTES

JiffyMON 64 Users: Use SYS 58564 to start the monitor with a SuperCPU enabled.

LIMITED WARRANTY

Creative Micro Designs, Inc., 15 Benton Dr., P.O. Box 646, East Longmeadow, Massachusetts warrants to the original retail purchaser of the SuperCPU that it is free of defects in material and workmanship for a period of 6 months from date of purchase from an authorized CMD dealer or 6 months from the date of delivery if purchased direct from CMD.

IMPLIED WARRANTIES, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE, ARE LIMITED IN DURATION TO THE DURATION OF THE EXPRESS WARRANTY SET FORTH ABOVE. IN NO EVENT SHALL CMD BE LIABLE FOR ANY LOSS, INCONVENIENCE, OR DAMAGE WHETHER DIRECT, INCIDENTAL, CONSEQUENTIAL OR OTHERWISE RESULTING FROM BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE, WITH RESPECT TO THE EQUIPMENT, EXCEPT AS SET FORTH HEREIN.

SOME STATES DO NOT ALLOW THE LIMITATIONS ON THE LIFE OF AN IMPLIED WARRANTY. SOME STATES MAY ALSO DISALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT PERTAIN TO YOU.

DESCRIPTION OF WARRANTY RIGHTS

From the date of purchase or date of delivery, in the case of a direct sale through CMD, through the warranty period, CMD will, at its discretion, repair or replace any part deemed to be defective at no charge for parts/labor to the original retail customer. During the applicable warranty period wherein CMD will repair or replace defective parts without charge for labor, all warranty inspections and repairs must be performed at a CMD authorized service agency or by CMD itself.

CONDITIONS TO WARRANTY SERVICE

For this warranty to become effective the following requirements must be met:

1. Any postage, insurance and shipping charges of warranted items to a CMD authorized service agency or CMD itself must be prepaid by the original retail purchaser and these costs are not included under this warranty. Return shipping during the warranty period will be paid by CMD to addresses in the continental U.S. All other addresses will be charged for shipping, insurance and any other charges related to the return shipping of the item.
2. The dealer's original bill of sale or a charge or credit or delivery receipt must be retained by the original retail purchaser as proof of purchase date of the warranted item and must be presented to the CMD authorized service agency or CMD itself when warranty claims are advanced.
3. The warranty registration card (if supplied) must be filled out and returned to CMD within 30 days of purchase. If CMD does not receive, in good condition, the warranty registration card within the 30 day period, all warranty services are forfeited by the original retail purchaser.
4. Any CMD product being returned for warranty repairs must be in its original shipping container or one of equivalent structure.

EXCLUSIONS FROM THE WARRANTY

This warranty does not cover the specific items/or conditions described below:

1. Equipment which has been damaged due to:
 - Accident, misuse, abuse, fire, flood, or "Acts of God" or other contingencies beyond the control of CMD.
 - Use of incorrect line voltages.
 - Improper or insufficient ventilation.
 - Failure to follow CMD's operating instructions.
 - Improper or unauthorized repair's.
 - Any unauthorized modification to the device.
 - Improper return packaging or damages caused by failure to insure.
2. Damage to warranted items sustained in shipment to the original retail purchaser.
3. Power transformer voltage or Power Supply conversion to foreign or domestic voltage or current frequency.
4. Any damage resulting from the infection of the unit by a computer virus.
5. Routine adjustments.
6. Damage resulting from the commercial use of this unit.

CMD will not be responsible for labor charges of unauthorized service agencies. CMD will not be responsible for labor charges from CMD authorized service agencies or CMD itself except during the warranty period applicable thereto. CMD will not be responsible for the loss or damage to equipment while in the possession of a CMD authorized service agency. CMD reserves the right to make changes in its design and improvements upon its product without assuming the obligation to install such changes on any of its products previously manufactured.

This warranty gives you specific legal rights and you may also have other rights which vary state to state.

RETURN POLICY

This unit may be returned to Creative Micro Designs, Inc. within 30 days of purchase for a refund of the purchase price less a 10% restocking fee. Shipping charges are not refundable.

Goods being returned must be returned in original condition in the original shipping container, freight prepaid, and must also include all accessories and be accompanied by a letter stating the reason for return. This letter should contain a return authorization number obtained from Creative Micro Designs, Inc. prior to the return of any package. The return authorization number should also be clearly visible in large characters on the shipping carton. Unidentified packages which do not contain an return authorization number will be refused.

JIFFYDOS COMMAND SUMMARY

Function Key Assignments

(F1)	@\$: * (RETURN)	Displays the directory of the currently selected drive
(F2)	/	LOAD a BASIC program (.dv)
(F3)	↑	LOAD and RUN a BASIC program (.dv)
(F4)	%	LOAD a Machine Language program (.dv,1)
(F5)	@D	LIST a BASIC program from disk
(F6)	@T	Display a PETASCII file from disk
(F7)	←	SAVE a BASIC program
(F8)	@ "S:	Scratch a file (or files)

Standard DOS 5.1 Wedge Commands*

@	Read the disk drive error channel
@C:newfile=file1[, file2]...	Copy a file on the same diskette
@I	Initialize the disk drive
@N:diskname,id	Format (NEW) a diskette
@N:diskname	Short NEW
@Q	Disable the JiffyDOS commands
@R:newname=oldname	Rename a file
@S:file1[, file2]...	Scratch a file (or files)
@UJ	Reset the disk drive
@V	Validate a disk
@\$[:pattern[=type]]	Display disk directory (supports pattern matching)
@#device	Set the default device number
/filename	LOAD a BASIC program (.dv)
↑filename	LOAD and RUN a BASIC program (.dv)
%filename	LOAD a Machine Language program (.dv,1)
←filename	SAVE a BASIC program

Additional JiffyDOS Commands

@B	Disable the 1541 head rattle
@D:filename	LIST a BASIC program from disk
@F	Disable the function keys
@G	Set interleave gapsize
@L:filename	Lock/Unlock a file
@O	Un-NEW a BASIC program
@P	Toggle printer output
@T:filename	Display a PETASCII file from disk
@X	Set Destination device number for Copy
*"filename" type	Copy a file (set Destination device first!)
£filename	LOAD and execute a Machine Language program
`filename	VERIFY a file
(CONTROL) A	Toggle all files for copy
(CONTROL) D	Default drive toggle
(CONTROL) P	Screen dump
(CONTROL) W	Toggle single file for copy
(SHIFT) (RUN)	LOAD and RUN first program on disk
SYS 58451	Re-enable the JiffyDOS commands (64 mode)
SYS 58551	Re-enable the JiffyDOS function keys and commands (64 mode)
SYS 65137	Re-enable the JiffyDOS commands (128 mode)

*Note: The @ wedge can be used to send any standard type of command supported by a device.

IMPORTANT

We have discontinued using number tags on the microclips. Instead, we ask that you use the following color codes to identify the microclips:

Red clip = 39

Yellow clip = 30

Blue clip = 29

Green clip = 28

Black clip = 24